

CSCI 361: Reading Assignment # 1

Your Name: _____

Due: Tuesday, Sept 10, in class

Assignment reading for lecture:

- Sipser Chapter 0 (Background and Definitions)
- *Optional:* Boaz Barak Textbook, Chapter 1 (<https://introtcs.org/public/index.html>)
 - Some definitions are stated more explicitly in this book!

Q1. If $A = \{1, 2, 3\}$ and $B = \{a\}$, what is the Cartesian product $A \times B$?

Q2. How many elements are in the set $\{0, 1\}^4$?

Q3. Give an example of a function that is one-to-one but not onto.

CSCI 361: Reading Assignment # 2

Your Name: _____

Due: Thursday, Sept 12, in class

Assigned reading for this lecture:

- Sipser Chap 1.2 (Nondeterministic Finite Automaton)

Question. Study the state diagram of the NFA N_4 in Figure 1.36 of Sipser and state the formal description of the 5-tuple of N_4 (including the transition function table) similar to the description of the NFA N_1 in Example 1.38.

CSCI 361: Reading Assignment # 3

Your Name: _____

Due: Tuesday, Sept 17, in class

Assigned reading for this lecture:

- Sipser Chap 1.3 (Regular Expressions)

Questions:

1. Have you used regular expressions (**regex**) in Unix commands or programming before?

2. What does the regular expression 0^*10^* describe?

CSCI 361: Reading Assignment # 4

Your Name: _____

Due: Tuesday, Sept 17, in class

Assigned reading for this lecture:

- Sipser Chap 1.4 (Non-regular Languages)

Questions:

1. How does the pumping lemma utilize the pigeonhole principle?
2. Does the pumping lemma give a necessary and sufficient condition for regularity?

CSCI 361: Reading Assignment # 5

Your Name: _____

Due: Tuesday, Oct 1, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 2.1 (Context-free Grammar)

Questions:

Consider the context-free grammar G_3 in Example 2.3 of the textbook and answer the following:

(a) Show the derivation of the string of the **aabaabbb** using the rules of the grammar.

(b) Can we design a DFA for the language identified by this grammar? Explain in one-or-two sentences.

CSCI 361: Reading Assignment # 6

Your Name: _____

Due: Thursday, Oct 3, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 2.2 (Push-down Automata)

Questions:

1. Similar to finite automata, are deterministic and nondeterministic push-down automata equivalent in their power?

2. In Definition 2.13, the transition function of a push-down automata is defined as

$$\delta: Q \times \Sigma_{\varepsilon} \times \Gamma_{\varepsilon} \longrightarrow \mathcal{P}(Q \times \Gamma_{\varepsilon})$$

Describe this transition informally in English using the stack and "push" and "pop" terminology.

3. Consider the PDA in Figure 2.15. What is the significance of the \$ tape symbol?

CSCI 361: Reading Assignment # 7

Your Name: _____

Due: Tuesday, Oct 8, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 2.3 (Non-Context-Free Languages)

Questions:

1. Read the pumping lemma for CFL and compare it to the pumping lemma for regular languages. What are the similarities and differences?
2. Consider a **regular** CFG (in which the RHS of every rule has exactly one variable in the rightmost position). What do the parse trees for strings derived from such grammars look like? Show what the pumping lemma reduces to for such grammars by drawing an analog of Figure 2.35 ("Surgery on parse trees")

CSCI 361: Reading Assignment # 8

Your Name: _____

Due: Thursday, Oct 10, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 3.1 (Turing Machines)

Questions:

1. Describe one similarity and one distinction between the **states** of a Turing and those of DFA/NFA/push-down automata.

2. Is the following True or False:

A Turing machine can move its head both left and right on its tape.

CSCI 361: Reading Assignment # 9

Your Name: _____

Due: Tuesday, Oct 29, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 4.2 (Undecidability)

Questions:

1. Why is the recognizer for A_{TM} described on Page 202 not a decider?
2. What is the correspondence between the set of all infinite binary sequences and the set of all languages that is used in the proof of Corollary 4.18?

CSCI 361: Reading Assignment # 10

Your Name: _____

Due: Tuesday, Oct 29, in class

Assigned reading for this lecture:

- Sipser Third Edition Chap 5.1 (Reducibility)

Questions:

1. Consider the TM M_2 in the proof of Theorem 5.3. What is the language of M_2 ?
2. Is the machine M_2 created to be run on any inputs? Explain your answer.